concentration is dripped on the amorphous silicon film **103** and is spin-coated by spinner **100** to form an aqueous film **104**. In this way, nickel is provided in contact with a surface of the amorphous silicon film **103**. (FIG. 1(A))

Next, the amorphous silicon film **103** is crystallized by heat treatment to obtain a crystalline silicon film **105**. Temperature of the heat treatment is 550° C. and the duration of the heat treatment is 4 hours. (FIG. 1(B))

A silicon oxide film **106** is formed to a thickness of several tens Å to 100 Å on a surface of the obtained crystalline silicon film **105** by a UV light irradiation in air

Next, a polycrystalline silicon film **107** is formed to a thickness of 600 Å by low pressure thermal CVD. It is not necessary to form the polycrystalline silicon film **107** with a film quality required for an active layer of a semiconductor. The actual film has a high defect density. It is preferred that this defect density is higher than defect density of the crystalline silicon film **105**.

Next, nickel element contained in the crystalline silicon film **105** is diffused into the polycrystalline silicon film **107** through the oxide film **106** by heat treatment. (FIG. 1(C)).

The lower limit of the heating temperature of this heat treatment is defined as a temperature at which nickel can diffuse and the lower limit is 400° C. or higher. The upper limit is defined as a strain point of the glass substrate **101**. Nickel element contained in the crystalline silicon film **105** diffuses into the polycrystalline silicon film **107** by this heat treatment to enable the nickel element concentration in the crystalline silicon film **105** to decrease.

Generally, by forming the polycrystalline silicon film **107** to a thickness more than that of the crystalline silicon film **105**, nickel concentration in the crystalline silicon film **105** can be lowered to half or less by the heat treatment.

Then, the amorphous silicon film **107** is removed by etching. Hydradine (N_2H_6) or ClF_3 gas can be used. Since the etching rate of the silicon oxide is extremely low and the silicon oxide film **106** serves as an etching stopper, only the polycrystalline silicon film **107** which has absorbed nickel can selectively be removed.

Next, the silicon oxide film **106** is removed by bufferred hydrofluoric acid and fluorine nitrate to obtain a crystalline silicon film **108** in a low nickel element concentration therein, as shown in FIG. 1(D).

Embodiment 10

An amorphous Si_xGe_{1-x} film ($0<x<1$) is used as a nickel element diffusion film for absorbing nickel element therein in this embodiment.

A process for fabricating a crystalline silicon film according to this embodiment is described with reference to FIG. 1. First, a silicon oxide film **102** is formed as a base film to a thickness of 3000 Å on Corning 7059 glass substrate **101** having a strain point of 593° C.

Next, an amorphous silicon film **103** is formed to a thickness of 600 Å by plasma CVD or low pressure thermal CVD. A nickel acetate solution adjusted to a prescribed nickel concentration is dripped on the amorphous silicon film **103**, and spin-coated by spinner **100** to form an aqueous film **104**. In this way, nickel element is provided in contact with a surface of the amorphous silicon film. (FIG. 1(A))

Next, the amorphous silicon film **103** is crystallized by heat treatment to obtain a crystalline silicon film **105**. The heating temperature is 550° C. and the heating duration is 4 hours. (FIG. 1(B)).

A silicon oxide film **106** is formed to a thickness of several tens A to 100 Å on a surface of the obtained crystalline silicon film **105** by a UV light irradiation in air.

Next, an amorphous Si_xGe_{1-x} film **107** is formed to a thickness of 600 Å by plasma CVD using a silane (SiH_4) and germane (GeH_4) as a raw material gas. In order to obtain the amorphous Si_xGe_{1-x} film **107** at a high defect density, low temperature is used as the substrate temperature during the film formation and the raw material gas is used without being diluted with hydrogen.

Next, nickel element contained in the crystalline silicon film **105** is diffused into the amorphous Si_xGe_{1-x} film **107** through the oxide film **106** by heat treatment. (FIG. 1(C)).

The lower limit of the heating temperature of this heat treatment is defined as a temperature at which nickel can be diffused. The lower limit is 400° C. or higher. The upper limit is defined as a strain point of the glass substrate **101**. The nickel element contained in the crystalline silicon film **105** is diffused into the amorphous Si_xGe_{1-x} film **107** to lower nickel element concentration in the crystalline silicon film **105**.

The Si_xGe_{1-x} film **107** is removed by etching. In order to use the silicon oxide film **106** as an etching stopper, an etching solution or etching gas having a high etching selectivity between the Si_xGe_{1-x} film **107** and the silicon oxide film **106** is used. In this way, only the Si_xGe_{1-x} film **107** which has absorbed nickel can be selectively removed.

Next, the silicon oxide film **106** is removed by bufferred hydrofluoric acid or fluorine nitrate to obtain a crystalline silicon film **108** with a low nickel element concentration, as shown in FIG. 1(D).

As described above, in accordance with the present invention, by the function of the metal element, the crystalline silicon film can be fabricated at a low temperature such as about 550° C. or less which is lower than the prior art. Consequently, the crystalline silicon film using a glass substrate can be obtained.

Further, a crystalline silicon film having a low density of metal element can be obtained by dispersing the metal element into the amorphous silicon film from the crystalline silicon film crystallized with the action of the metal element. Consequently, a device free from the bad influence of the metal element, for example, a thin film transistor can be obtained by using a crystalline silicon film.

Further, the crystalline silicon film free from the deviation of the metal element can be obtained by dispelling to a second silicon film a portion where the metal element in the silicon film crystallized by the action of the metal element is deviated. In this manner, a device free from the bad influence of the metal element can be obtained.

What is claimed is:

1. A method for fabricating a semiconductor thin film comprising the steps of:
   - providing an amorphous semiconductor film with a metal element which promotes crystallization of said semiconductor film;
   - crystallizing said amorphous semiconductor film by heat treatment to obtain a crystalline semiconductor film;
   - forming a silicon nitride film in contact with said crystalline semiconductor film;
   - forming a metal element diffusion film comprising a semiconductor in contact with said silicon nitride film;
   - diffusing said metal element into said metal element diffusion film; and
   - removing said metal element diffusion film into which said metal element has been diffused, using said silicon nitride film as an etching stopper.

2. A method for fabricating a semiconductor thin film comprising the steps of:
   - providing an amorphous silicon film with a metal element which promotes crystallization of said silicon film;

obtaining a crystalline silicon film by crystallizing said amorphous silicon film by heat treatment;

forming a silicon nitride film in contact with said crystalline silicon film;

forming an amorphous semiconductor film in contact with said silicon nitride film;

dispersing by heat treatment the metal element in said crystalline silicon film into the amorphous semiconductor film formed in contact with said silicon nitride film; and

removing the semiconductor film formed in contact with said silicon nitride film by using said silicon nitride film as an etching stopper.

3. The method of claim 2 wherein said amorphous semiconductor film comprises silicon.

4. A method for fabricating a semiconductor thin film comprising the steps of:

providing an amorphous silicon film with a metal element which promotes crystallization of said silicon film;

obtaining a crystalline silicon film by crystallizing said amorphous silicon film by heat treatment;

forming a silicon nitride film in contact with said crystalline silicon film;

forming an amorphous semiconductor film in contact with said silicon nitride film;

crystallizing by heat treatment the amorphous semiconductor film which is formed in contact with said silicon nitride film; and

removing the semiconductor film which is formed in contact with said silicon nitride film by using said silicon nitride film as an etching stopper.

5. The method of claim 4 wherein said amorphous semiconductor film comprises silicon.

6. A method for fabricating a semiconductor thin film comprising the steps of:

providing an amorphous semiconductor film with a metal element which promotes crystallization of said semiconductor film;

crystallizing said amorphous semiconductor film by heat treatment to obtain a crystalline semiconductor film;

forming a silicon nitride film in contact with said semiconductor film;

forming a metal element diffusion film comprising a semiconductor in contact with said silicon nitride film;

diffusing said metal element into said metal element diffusion film; and

removing said metal element diffusion film into which said metal element has been diffused.

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